Title : Gear and Thread Manufacturing Process(Production Technology)

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Different type of Thread Manufacturing Method

Methods of producing screw threads by;
Machines And Tools Used For Producing Screw Threads By

(a) Machining
(b) Rolling
(c) Grinding

Production of screw threads by machining

Thread cutting by hand operated tools: Usually small threads in few pieces of relatively soft ductile materials, if required, are made manually in fitting, repair or maintenance shops.

External screw threads

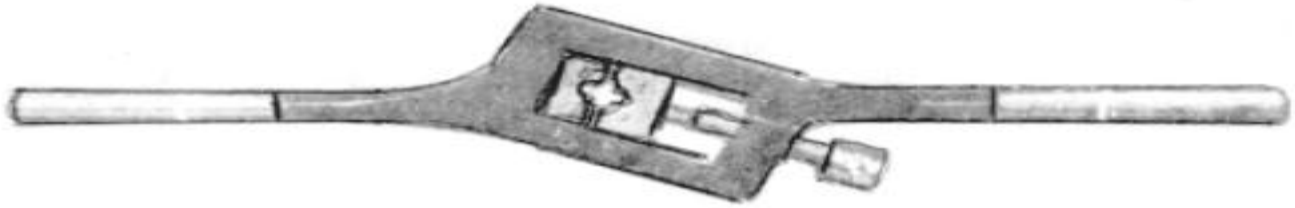
Machine screws, bolts or studs are made by different types of dies which look and apparently behave like nuts but made of hardened tool steel and having sharp internal cutting edges. Fig. shows the hand operated dies of common use, which are coaxially rotated around the premachined rod like blank with the help of handle or die stock.

- **Solid or button die** : used for making threads of usually small pitch and diameter in one pass.
- **Spring die** : the die ring is provided with a slit, the width of which is adjustable by a screw to enable elastically slight reduction in the bore and thus cut the thread in number of passes with lesser force on hands.

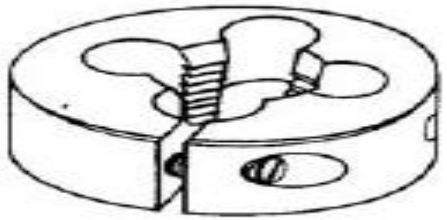
Split die : The die is made in two pieces, one fixed and one movable (adjustable) within the cavity of the handle or wrench to enable cut relatively larger threads or fine threads on harder blanks easily in number of passes, the die pieces can be replaced by another pair for cutting different threads within small range of variation in size and pitch.

Pipe die : Pipe threads of large diameter but smaller pitch are cut by manually rotating the large wrench (stock) in which the die is fitted through a guide bush as shown in **Fig.**

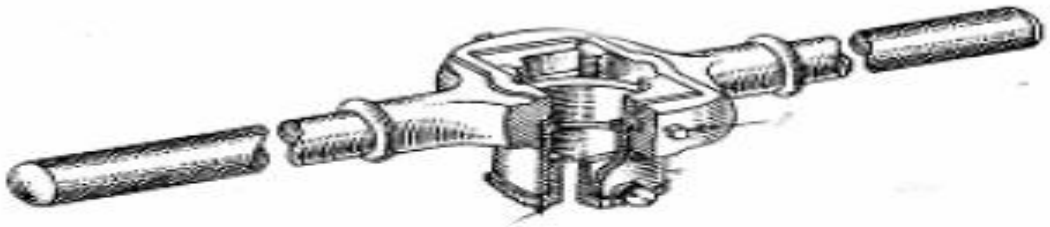
(a) solid die



(c) split die



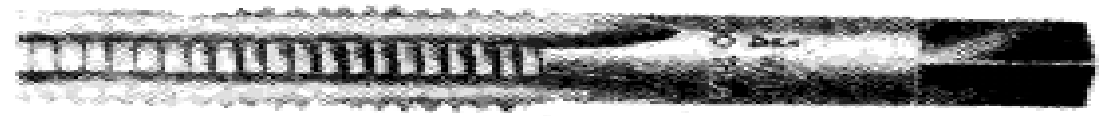
(b) spring die



(d) pipe die

Internal screw threads :

Internal screw threads of usually small size are cut manually, if needed, in plates, blocks, machine parts etc. by using taps which look and behave like a screw but made of tool steel or HSS and have sharp cutting edges produced by axial grooving over the threads as shown in **Fig. 7.1.2**. Three taps namely, taper tap, plug tap and bottoming tap are used consecutively after drilling a tap size hole through which the taps are axially pushed helically with the help of a handle or wrench.



(*a*) Taper tap

(*b*) Second tap

(*c*) Plug tap

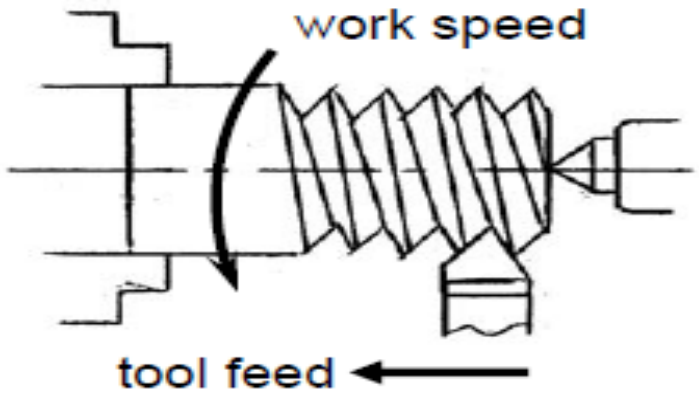
Machining screw threads in machine tools

Threads of fasteners in large quantity and precision threads in batches or lots are produced in different machine tools mainly lathes, by various cutting tools made of HSS or often cemented carbide tools.

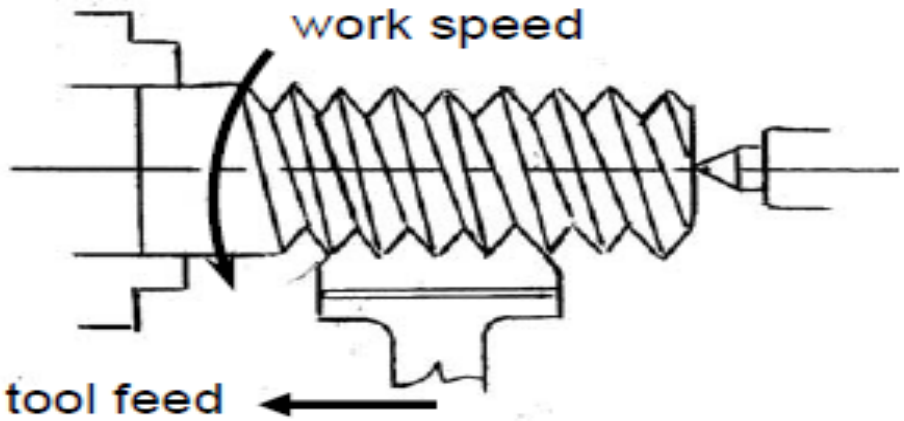
- **External threads :**

External threads are produced in centre lathes by various methods :

- **Single point and multipoint chasing**, as schematically shown in **Fig. 7.1.4** This process is slow but can provide high quality. Multipoint chasing gives more productivity but at the cost of quality to some extent



(a) single point



(b) multipoint

△ **Thread milling:**

This process gives quite fast production by using suitable thread milling cutters in centre lathes as indicated in **Fig. 7.1.5**. The milling attachment is mounted on the saddle of the lathe. Thread milling is of two types;

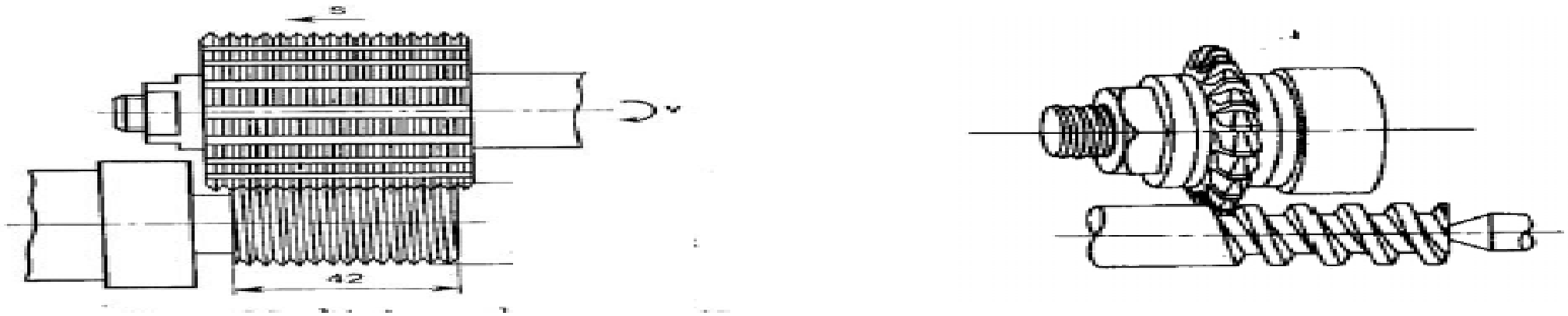


Fig. 7.1.5 *Thread milling by attachment in centre lathes.*

- **Long thread milling**

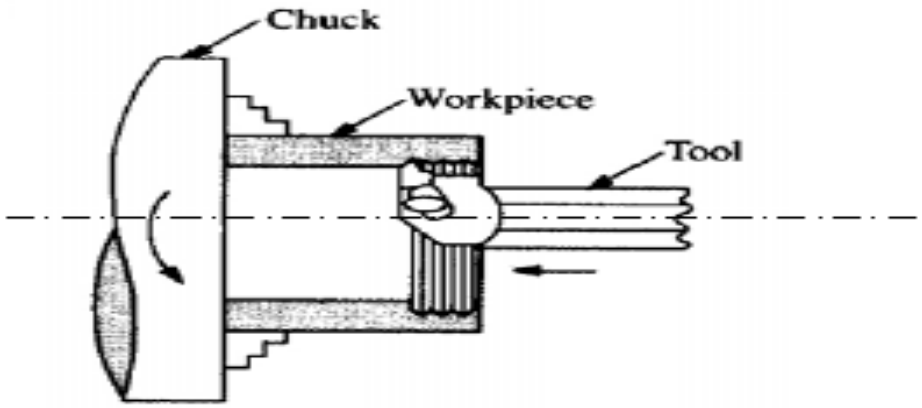
Long and large diameter screws like machine lead screws are reasonably accurately made by using a large disc type form milling cutter as shown in **Fig. 7.1.5**.

- **Short thread milling**

Threads of shorter length and fine pitch are machined at high production rate by using a HSS milling cutter having a number of annular threads with axial grooves cut on it for generating cutting edges. Each job requires only around 1.25 revolution of the blank and very short axial (1.25 pitch) and radial (1.5 pitch) travel of the rotating tool

Δ Internal threading by single point chasing

Internal threads in parts of wide ranges of diameter and pitch are accurately done in centre lathes by single point tool, as in boring, as shown in **Fig. 7.1.7 (a)**. Multipoint flat chaser is often used for faster production.



(a)

(b)

(c)

Fig. 7.1.7 *(a) single point tool , (b) solid tap and (c) milling cutter for internal threading in centre lathe.*

(b) Production of screw threads by thread rolling

In production of screw threads, compared to machining thread rolling,

- is generally cold working process
- provides higher strength to the threads
- does not cause any material loss
- does not require that high accuracy and finish of the blank
- requires simpler machines and tools
- applicable for threads of smaller diameter, shorter length and finer pitch
- enables much faster production of small products like screws, bolts, studs etc.
- cannot provide that high accuracy
- is applicable for relatively softer metals
- is used mostly for making external screw threads
- needs separate dies for different threads

Thread rolling is accomplished by shifting work material by plastic deformation, instead of cutting or separation, with the help of a pair of dies having same threads desired..

Different types of dies and methods are used for thread rolling which include,

- Thread rolling between two flat dies
- Thread rolling between a pair of circular dies

- **Rolling of external screw threads by flat dies**

The basic principle is schematically shown in **Fig. 7.1.11**. Flat dies; one fixed and the other moving parallely, are used in three configurations :

- Δ **Horizontal** : most convenient and common
- Δ **Vertical** : occupies less space and facilitates cleaning and lubrication under gravity
- Δ **Inclined** : derives benefit of both horizontal and vertical features

All the flat dies are made of hardened cold die steel and provided with linear parallel threads like grooves of geometry as that of the desired thread.

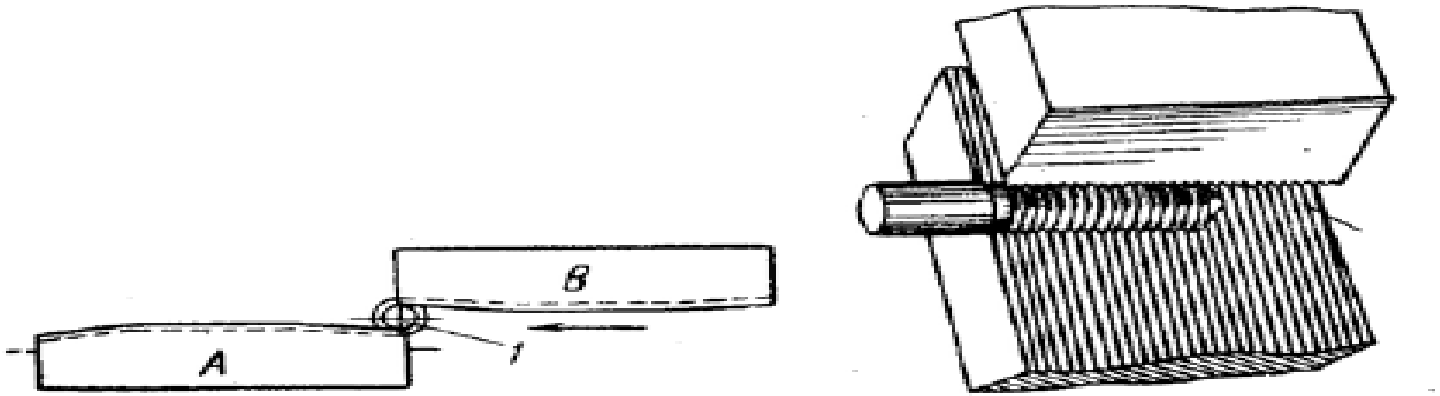


Fig. 7.1.11 *Principle of thread rolling by flat dies.*

- **Thread rolling by circular dies**

Circular die sets occupy less space and are simpler in design, construction, operation and maintenance. The different types of thread rolling circular dies of common use and their working methods are :

- **Circular dies with plunge (radial) feed :**
  The two identical circular dies with parallel axis are rotated in the same direction and speed as indicated in **Fig. 7.1.12**. One stays fixed in a position the other is moved radially desirably depending upon the thread depth

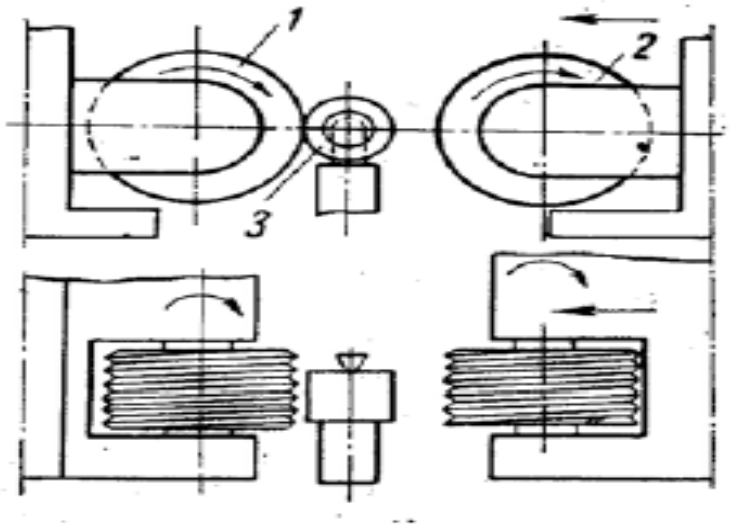


Fig. 7.1.12 *Principle of thread rolling by circular die with plunge feed*

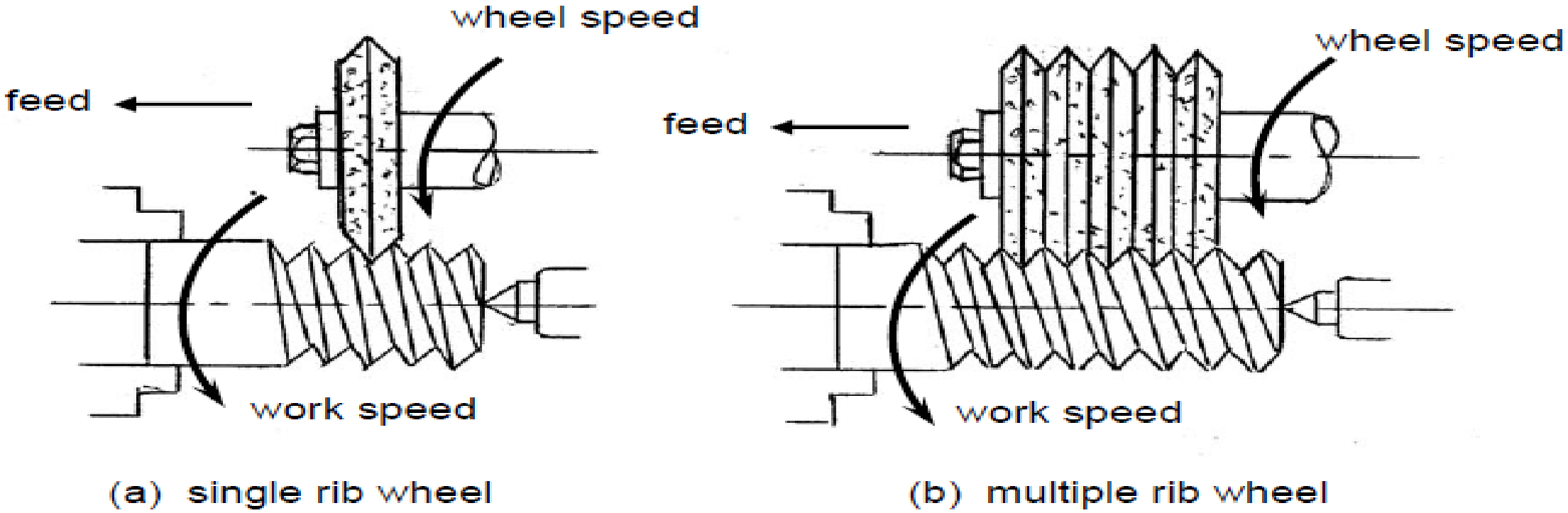
(c) Finishing and production of screw threads by grinding

In production of screw threads, grinding is employed for two purposes;

- Finishing the threads after machining or even rolling when
  - High dimensional and form accuracy as well as surface finsh are required, e.g., screw threads of precision machines and measuring instruments
  - The threaded parts are essentially hardened and cannot be machined or rolled further, e.g., leadscrews of machine tools, press – screws etc.
- Directly originating (cutting) and simultaneously finishing threads in any hard or soft preformed blanks. This is employed generally for finer threads of small pitch on large and rigid blanks

However screw threads are ground in several methods which include;

- **External and internal thread grinding** by single ribbed formed grinding wheel as schematically shown in **Fig. 7.1.16 (a)**. Such grinding is usually done in cylindrical grinding machine but is also occasionally done in rigid centre lathes by mounting a grinding attachment like thread milling attachment, on the lathe's saddle.
- **Multi-ribbed wheels** save grinding time by reducing the length of travel of the wheel but raises wheel cost. **Fig. 7.1.16 (b)** shows such thread grinding with both fully covered and alternate ribbing.



(a) single rib wheel (b) multiple rib wheel

Fig. 7.1.16 *Grinding of external screw threads.*

Δ **External threads by centreless grinding**

Like centreless grinding of short and long rods by plunge feed and through feed respectively, centreless thread grinding is also done by ribbed grinding wheel using respectively parallel and desirably inclined plain guide wheels. Centreless grinding, if feasible, is more productive but at the cost of accuracy to some extent.

Q. 1 State various thread manufacturing methods. Explain any two of them briefly.

Q. 2 Explain following: Split die, Pipe Die

Q. 3 What are the various finishing method for Thread Manufacturing process.

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